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| viewpoints: what are the benefits? | |
| Here are scientists' views on how GM crops can help the environment (reducing the need for herbicides, pesticides), the farmer (pathogen resistance), and make it easier to feed the world (enhanced crops with vitamins). Critics of agricultural biotechnology say there are other, better options for solving these problems. |  |

**Charles Arntzen, Ph.D.**

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We're just at the tip of the iceberg of an enormous number of things that will be technically possible to do with plants. Some folks are talking about how they are going to change the qualities of plants so that they'll be able to do bio-remediation and clean up toxic sites. To some extent, that is a viable technology and it's a sustainable way of dealing with complex issues. ...

We're going to find more examples where [it's going to be much easier to] switch off a gene or an enzyme in a plant, or add some new component. [For instance], if we can just cut down the amount of lignin in the poplar trees that we're growing for paper pulp to make newspapers, [we'll get] less lignin contamination in streams and waterways. That makes a lot of sense. ... [Over time], the power of genetics--[which can provide] a sustainable modification of a biological resource--is going to be the much-preferred avenue over using cost-intensive industrial processes to do the same thing.   
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**Norman Borlaug, Ph.D.**

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... If we use high-yield technology, which we have done beautifully in the last 50 years, to increase the food that we need, we leave undisturbed vast tracts of marginal land which, if we opened to cultivation because of lack of rainfall or topography, would erode badly. They would become unproductive in a few years. Instead, [using] high-yield [agricultural practices] on the land [that is] best suited, you leave undisturbed many of these areas for wildlife habitat, for outdoor recreation, and for forestry. ...

There are many other things. Stop to think what would happen to corn production if you could put a gene into it that will withstand 3 or 4 degrees of frost. Corn is one of the most sensitive--it and beans--to light frost. Then you could plant earlier in the spring, when moisture is more plentiful. ... It will increase yield. It will shift corn production to earlier planting. We are just seeing some of the first things that have been useful.   
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**Martina McGloughlin, Ph.D.**

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**[Why use the BT gene to modify crops?] ...**

Farmers are incredibly productive, but it does come at a price. There is a lot of contamination of soils and groundwater with the excess use of chemicals that are used to control weeds and insects and pests. So this was an obvious area that biotech could very quickly address issues of interest to the farming community. ... At that point in time, the biotech companies weren't thinking specifically of the consumer. They really were thinking of the farmer. ...

Last year, 55 percent of all soybeans were genetically engineered for another type of resistance gene, and this was herbicide tolerance. What this herbicide tolerance gene does is allow a far more environmentally compatible herbicide--glyphosate--to be used to control weeds. ... A recent report from the U.S. National Food and Ag Council in Washington has shown that using herbicide-tolerant soybeans, there was a savings of $280 million by farmers in 1998. This allowed them to use just a single herbicide. They only had to spray if the weeds emerged. They didn't have to use multiple sprayings or pre-sprayings. Likewise, they didn't have to use complex cocktails of really pretty nasty herbicides. ...

**Take corn and cotton. What kind of pathogens attack these crops?**

The main pathogen, especially for corn, is European corn borer. That particular pathogen comes up through the stalk of the plant itself, and it's very difficult to get at because it's literally inside the stalk, and you really oftentimes don't realize you have a problem until the ears fall off. That's not very good for farmers, and there's no really good way of being able to control them right now, even using traditional chemical pesticides.

With the BT gene in the corn itself, when the larvae eat [it], they are immediately affected. If you look at the two plants--the control plant and the engineered plant--it's like night and day. The control plant is just completely infected with the European corn borer. The BT plant is completely clean.   
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**Charles Margulis**

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**Farmers have been among the first beneficiaries [of BT crops]. A cotton farmer uses less pesticides and grows better cotton. He's saving his environment. How do you answer him?**

I would say that he's the exception rather than the rule. ... Even the biotech industry's own study on BT crops showed, at best, cotton farmers are seeing about a 12 percent decrease in chemical applications. ... Once those [insects that are resistant to BT] evolve, you're going to be stuck going back to that biotech company, either for more toxic chemicals or for the next generation of genetically engineered crops. They're going to be more and more costly, and keep you more and more dependent.

It's the same kind of treadmill that farmers have seen from the pesticide industry for 50 years. The average life span of an agri-chemical is about 3 to 5 years. Then nature evolves, the chemical doesn't work anymore, and farmers have to go back to the company for the next greatest thing. ...   
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**Jeremy Rifkin**

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**I visited a farmer in the Midwest, and they just used two applications of Roundup Ready, one at the beginning of the season and one halfway through. Much less than they've ever used before. ...**

I know quite a few farmers all over the United States who have tried this and have said the opposite, that they have to use more herbicides, not less. The same holds true with BT. Monsanto says, "We're going to introduce a little gene into the plant that codes for a pesticide." Every cell of the plant is producing that pesticide, so the insect tries to eat the plant and dies when it tries to digest the material. Monsanto says, "This is a leap forward. We're ending pesticides, groundwater contamination."

Well, yes and no. Yes, they're ending the use of pesticides. But now they're introducing more toxin than they ever introduced with pesticides. When you spray a pesticide, it's infrequent, it's periodic. When you are putting the same toxin in the form of a gene into the plant, that plant is producing that toxin 24/7, perpetually over millions of acres. ... A major study just came out in Science or Nature this year showing that when you introduce the gene for toxicity, it is going into the ground soil. ...   
  
Developing Countries  
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**Charles Arntzen, Ph.D.**

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[With genetic engineering], we can put things like vitamin A into a rice plant. ... It's going to solve major problems in the developing world, as to [the] availability of food materials for good nutrition.

[I know] a standard response is, "Well, they should just be eating more green leafy vegetables." I've been to India. I've stayed in a very nice hotel in [the] center [of] New Delhi. Families [are] living on the sidewalk on an old patch of blanket. ... They no longer have a little garden plot to grow their materials. They're stuck in a concrete jungle someplace [where] they don't have access to green leafy vegetables and they're living on a handful of rice every day. The Rockefeller Foundation and others [are] recognizing this, and they have focused on issues like [changing] the quality of that food that they do have available. ...   
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**Martina McGloughlin, Ph.D.**

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**Some environmental groups argue for a return to another way of life. "We have enough food. We just need to distribute it." They're not moved by your environmental arguments, and they're trying to escape from your Third World developing country arguments.**

It would be wonderful if we could all live in a bucolic Turner chocolate-box environment, where we all are back working on the earth, looking like a scene from American Gothic. But that's not a reality. ... The reality is, if you're going to look at the productivity that you could achieve by going back to zero-input agriculture, versus what you can achieve using biotech means, they just do not balance up. The costs would literally skyrocket. You can even see that today, with the cost of organic produce. ...

**Poor farmers in developing countries are organic farmers, and they don't want to be. [They'd rather have access to the new agricultural technologies.]**

It's very difficult for them. I always like to quote a researcher from Kenya. Florence Wambugu has said, "The real advantage of biotech is, it's package technology in the seed." You don't have to teach these farmers new culture practices. You don't have to get them to completely change the way they do farming. You just give them a seed, and that increases productivity in that seed itself. She said [that] for years people have tried to change cultural practices of these farmers, and it just hasn't worked. It has been a complete failure, because you have to modify infrastructure, you have to re-educate them as to how to modify their farming practices themselves. But with biotech, the technology is in a seed. All you have to do is give them the seed.

At this stage, about 40 different countries are capable of producing these biotech products. They don't have to depend on the U.S. or First World countries to provide them with this technology.   
  
**Jane Rissler, Ph.D.**

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**Some say the greatest beneficiaries of this technology will be people in the developing world. What do you make of these arguments?**

I think it's a ploy. It's a ploy to convince relatively well-to-do people in the industrialized world to approve of this technology. It's playing on the guilt of relatively well-off people, that somehow if they don't approve of this technology by agreeing to buy the products, the result will be people dying of starvation in the developing world.

**You don't believe this technology can help people in the developing world?**

The biggest problem behind hungry people is lack of money. It's not technology. There's plenty of food right now, and there're people starving. Putting vitamin A in rice, making high-protein corn, perhaps they have some value. But the better approach would be that people could buy food that would give a well balanced diet, instead of having to pile all the nutrients into one type of food or two types of food. So I don't think we ought to be deluded. Technology is not the obstacle to feeding people. It's poverty. ...

**How about the idea of edible vaccines? Do you not see any benefit?**

These are ideas that people have, and I think they have noble purposes. I think that the problems are more complicated. ... I don't mean to be disparaging of all these scientists who have really noble goals. But I do see people perhaps overlooking more practical but less sensational solutions to very important problems. ... It seems the sexy thing to do, to apply biotechnology to a range of problems, without really considering that there may be simple, practical, feasible alternatives.   
  
**Charles Margulis**

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**Some people in the developing world, scientists, [support the development of genetically modified foods]. It's not a fringe view [and Greenpeace will] have to deal with this constituency, which is more sympathetic than Monsanto.**

Monsanto and the biotech industry have used this as a public relations tool. There are certainly voices from everywhere in the world who will be supportive of biotechnology. But by and large, when it came down to their governments' representatives, the developing world was united in saying, "We want the right to say no to this technology." ...

We live in a world today where 800 million people a year are going hungry, in a world that produces enough food for almost 9 billion people. Yet we only have 6 billion people on the planet. Why isn't that food being distributed more equitably? It's because people who can't afford to buy food simply aren't being given it. ...

**But people in these countries don't want to be just fed food. They want to grow their own.**

In almost every country in the world, there is enough productive growth right now to feed the population of that country. But many countries where people are going hungry are exporting food. That's because food gets sold for a profit. It doesn't get given away. And if people in that country can't afford to buy it, it's going to be grown and exported